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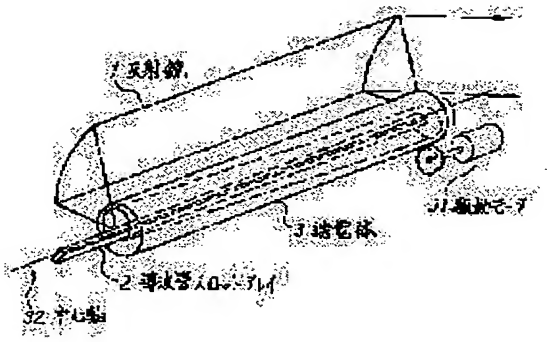
(54) RADAR ANTENNA

(57)Abstract:
PURPOSE: To obtain the radar antenna able to reciprocate at a high speed laterally a far beam narrow in the lateral direction and wide in the longitudinal direction.
CONSTITUTION: A reflecting mirror 1 of a quadrilateral long laterally is parabolic in a cross section in the short direction. A radio wave radiation wall face of a waveguide slot array 2 is arranged while being directed in a face of the reflected mirror at a position roughly coincident with a focal point 4 of the reflecting mirror. A dielectric body 3 is a hollow cylinder and driven around a center axis 32 of an outer cylinder while a waveguide slot array is penetrated in the hollow part. The hollow part is cylindrical but its center axis is not coincident with the center axis 32 of the outer cylinder but tilted. A radio wave radiating from the waveguide slot array is bent in the lateral direction by a refraction of a dielectric body but reciprocated laterally in response to the turning of the dielectric body and a fan beam is emitted from a laterally long reflecting mirror while being reciprocated at a high speed laterally.



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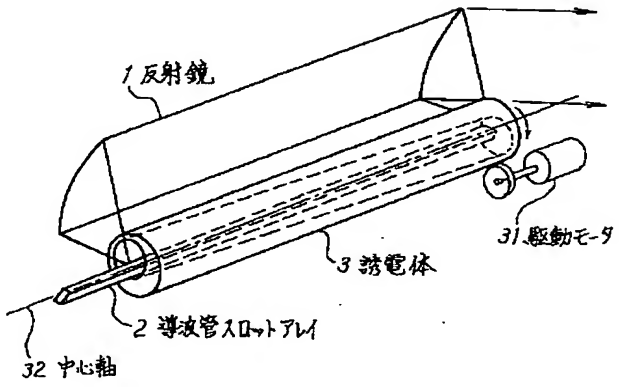
(54) 【発明の名称】レーダアンテナ

(57) 【要約】

【目的】 横方向に狭く縦方向に広いファンビームを横方向に高速に往復動作させ得るレーダアンテナを提供する。

【構成】 横長4辺形の反射鏡1は短手方向断面が放物線状をなしている。導波管スロットアレイ2はその電波放射壁面を反射鏡の焦点4の位置と概ね一致した位置において反射鏡面に指向させて配置される。誘電体3は中空円筒状のもので中空部に導波管スロットアレイが貫通配置された状態で外円柱の中心軸32を中心に回転駆動されるが、中空部は円柱状であるがその中心軸が外円柱の中心軸32と一致せず傾斜している。導波管スロットアレイが放射した電波は誘電体の屈折作用により行路が横方向に曲げられるが、誘電体の回転に応じて横方向に往復し、横長反射鏡からファンビームが横方向に高速に往復動されて放射される。



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【特許請求の範囲】

【請求項１】　横長４辺形の反射鏡であって短手方向断面が放物線状をなす反射鏡と；　多数のスロットが形成される電波放射壁面を前記反射鏡の焦点位置と概ね一致した位置において反射鏡面に指向させて配置される導波管スロットアレイと；　中空円筒状の誘電体であって、前記導波管スロットアレイが貫通配置される中空部は円柱状であるがその中心軸が外円柱の中心軸と一致せず傾斜して形成されていると共に、外円柱の中心軸を中心に回転駆動される誘電体と；　を備えたことを特徴とするレーダアンテナ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、横方向に狭く縦方向に広いファンビームを横方向に高速に往復動作させ得るレーダアンテナに関する。

【０００２】

【従来の技術】例えば走行する車両において進行方向のある角度範囲を常時監視し障害物等を逸早く検出する用途に用いられるレーダでは、走査方向である横方向の分解能を高くする必要がある。かかる目的に好適なアンテナビームは、横方向に狭く縦方向に広いファンビームである。

【０００３】

【発明が解決しようとする課題】しかし、上記目的に使用されるレーダでは、ファンビームを横方向に高速に往復動作させねばならないが、機械的にアンテナ全体を右回転と左回転を交互して行わせファンビームを左右に往復動させる方式では走査速度に限界があり、またフェーズドアレイを用いる方式では位相制御が面倒であるという問題がある。

【０００４】本発明は、このような問題に鑑みなされたもので、その目的は、簡単な構成で横方向に高速に往復動作するファンビームを発生できるレーダアンテナを提供することにある。

【０００５】

【課題を解決するための手段】前記目的を達成するため本発明のレーダアンテナは次の如き構成を有する。即ち、本発明のレーダアンテナは、横長４辺形の反射鏡であって短手方向断面が放物線状をなす反射鏡と；　多数のスロットが形成される電波放射壁面を前記反射鏡の焦点位置と概ね一致した位置において反射鏡面に指向させて配置される導波管スロットアレイと；　中空円筒状の誘電体であって、前記導波管スロットアレイが貫通配置される中空部は円柱状であるがその中心軸が外円柱の中心軸と一致せず傾斜して形成されていると共に、外円柱の中心軸を中心に回転駆動される誘電体と；　を備えたことを特徴とするものである。

【０００６】

【作用】次に、前記の如く構成される本発明のレーダアンテナの作用を説明する。導波管スロットアレイは、各スロットから位相の揃った電磁波を放射させることができるので、管軸を中心とする円筒状の波面を持つ電磁波を放射し、誘電体がない場合に反射鏡で反射され射出される電磁波は導波管スロットアレイの管軸に平行な波面を持つ平面波となる。そして、誘電体が介在するとその屈折作用により平面波の指向方向が曲げられるが、誘電体は中空部がいわば偏心しているのでその回転により平面波の指向方向は横方向に往復変化する。この往復動作の速度は、誘電体の回転速度の制御により任意に設定でき、容易に高速化が図れる。また、反射鏡は横長であるから、反射鏡の放射ビームは、横方向に狭く縦方向に広いファンビームである。

【０００７】斯くして、本発明によれば、簡単な構成で横方向に高速に往復動作するファンビームを発生できることになる。

【０００８】

【実施例】以下、本発明の実施例を図面を参照して説明する。図１は、本発明の一実施例に係るレーダアンテナを示す。このレーダアンテナは、反射鏡１と導波管スロットアレイ２と誘電体３と駆動モータ３１とを基本的に備える。

【０００９】図２乃至図４に各部の詳細を示してあるが、反射鏡１は横長４辺形のもので、短手方向断面が放物線状をなしている。

【００１０】導波管スロットアレイ２は、反射鏡１の鏡面に平行して配置されるが、その１壁面に多数のスロット２１が一定の間隔で穿設されて電波放射壁面を形成し、この電波放射壁面を反射鏡１の焦点４の位置と概ね一致した位置において反射鏡面に指向させて配置される。

【００１１】誘電体３は、中空円筒状のもので、その中空部内に導波管スロットアレイ２が貫通配置された状態で駆動モータ３１により外円柱の中心軸３２を中心に回転できる構造となっているが、この中空部は円柱状で、しかもその中心軸が外円柱の中心軸３２と一致せず傾斜して形成されている。

【００１２】以上の構成において、図３及び図４では、導波管スロットアレイへの給電は図中左方から行うように示してあるが、スロット２１の配置間隔を導波管内を伝搬する電磁波の管内波長と等しい間隔に設定すれば、各スロット２１から放射される電磁波の位相は等しくなり、導波管スロットアレイ２からは、管軸を中心とする円筒状の波面を持つ電磁波が放射される。

【００１３】従って、誘電体３が存在しない場合に反射鏡１で反射され射出される電磁波は導波管スロットアレイ２の管軸に平行な波面を持つ平面波となる。そして、誘電体３が介在するとその屈折作用により平面波の指向方向が曲げられるが、誘電体３は中空部がいわば偏心し、しかも回転しているので、平面波の指向方向は、図

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５に示すように、回転状態に応じて横方向に、（ａ）→（ｂ）→（ｃ）→（ａ）と順次変化し、往復変化する。この往復動作の速度は、誘電体３の回転速度の制御により任意に設定でき、容易に高速化できる。

【００１４】そして、反射鏡１は横長であるから、反射鏡の放射ビームは、横方向に狭く縦方向に広いファンビームである。

【００１５】斯くして、簡単な構成で横方向に高速に往復動作されるファンビームを発生できるのである。

【００１６】

【発明の効果】以上説明したように、本発明のレーダアンテナでは、いわば偏心した中空部を備える円筒状の誘電体のその中空部内に導波管スロットアレイを貫通配置し、誘電体を回転させ、横長反射鏡に到達する電波の行路を横方向へ往復変化させるという簡単な構成で横方向に高速に往復動作されるファンビームを発生できる。従って、当該アンテナを用いたレーダでは、横方向の分解能を容易に上げることができ、車両に搭載して障害物等の検出の目的に使用するレーダに好適なレーダアンテナを提供できる効果がある。

【図面の簡単な説明】

【図１】本発明の一実施例に係るレーダアンテナの外観構成図である。

【図２】図１のレーダアンテナを導波管スロットアレイの管軸に垂直な面で切断した断面図である。

【図３】導波管スロットアレイと誘電体の関係を示す断面図である。

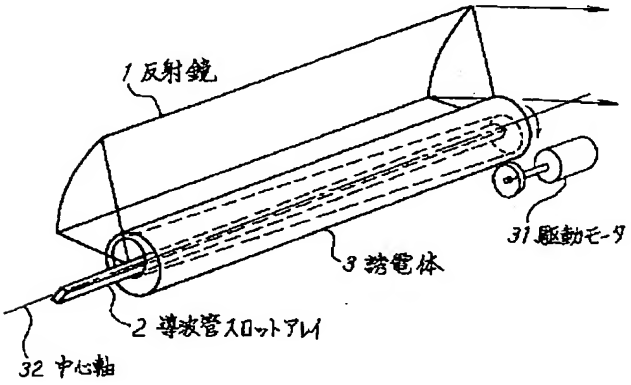
【図４】導波管スロットアレイの電波放射壁面の概略図である。

【図５】動作説明図である。

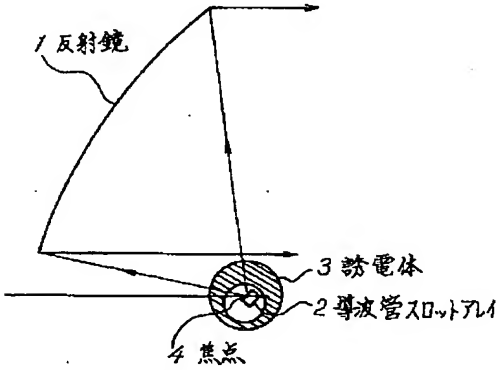
【符号の説明】

１　反射鏡
２　導波管スロットアレイ
３　誘電体
４　焦点
２１　スロット
３１　駆動モータ
３２　中心軸

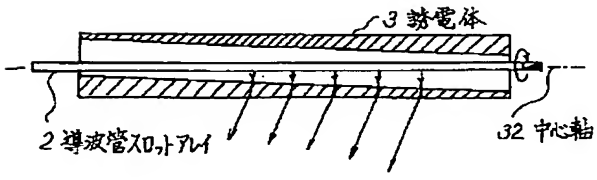
【図１】



【図２】

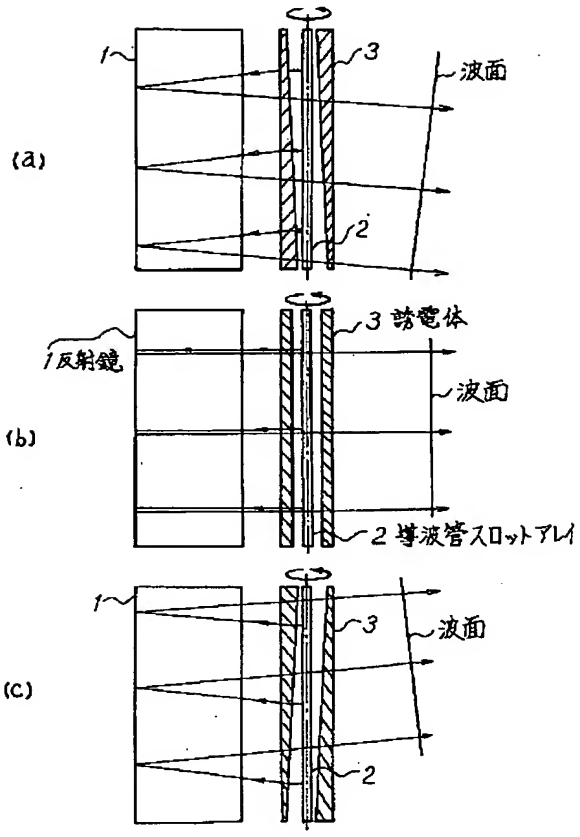


【図３】



【図４】

【図５】



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Epitome

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(57) [Abstract]
[Objects of the Invention] A longitudinal direction is provided with the radar antenna which may make a high speed carry out both-way actuation of the narrow fan beam large to a lengthwise direction in a longitudinal direction.
[Elements of the Invention] As for the reflecting mirror 1 of an oblong four-side form, the direction cross section of a short hand is making parabolic. The waveguide slot array 2 makes a reflecting mirror side point to the rf radiation wall surface in the location of the focus 4 of a reflecting mirror, and the location which was in agreement in general, and is arranged. A dielectric 3 is a bell shape thing, where penetration arrangement of the waveguide slot array is carried out at a centrum, a rotation drive is carried out a core [the medial axis 32 of an outside cylinder], but although the centrum is cylindrical, the medial axis is not in agreement with the medial axis 32 of an outside cylinder, and it inclines. Although a course is bent in a longitudinal direction according to a refraction operation of a dielectric, according to rotation of a dielectric, it goes and comes back to the electric wave which waveguide slot array emitted in a longitudinal direction, and from an oblong reflecting mirror, a fan beam reciprocates at a high speed and is emitted to a longitudinal direction.

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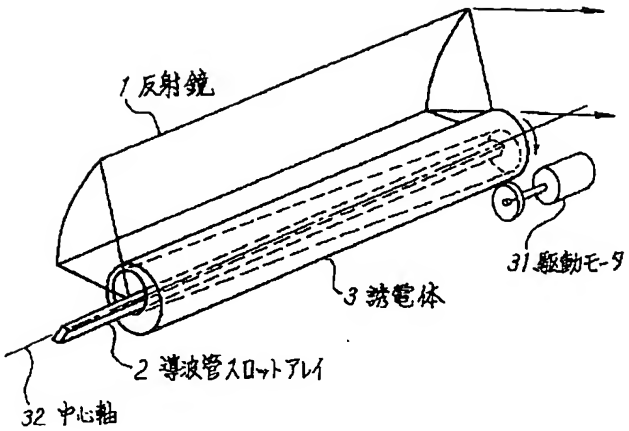

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
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CLAIMS

[Claim(s)]

[Claim 1] Reflecting mirror with which it is the reflecting mirror of an oblong four-side form, and the direction cross section of a short hand makes parabolic; Waveguide slot array which a reflecting mirror side is made to point to the rf radiation wall surface in which many slots are formed in the focal location of said reflecting mirror, and the location which was in agreement in general, and is arranged; It is a bell shape dielectric. The centrum by which penetration arrangement of said waveguide slot array is carried out is a rotation drive dielectric centering on the medial axis of an outside cylinder although it is cylindrical, while it is not in agreement with the medial axis of an outside cylinder, and the medial axis inclines and is formed.; Radar antenna characterized by having.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the radar antenna which may make a high speed carry out both-way actuation of the fan beam [narrow in a longitudinal direction] large to a lengthwise direction in a longitudinal direction.
[0002]
[Description of the Prior Art] for example, the include-angle range which has a travelling direction in the car it runs -- monitoring continuously -- an obstruction etc. -- ** -- it is necessary to make high resolution of the longitudinal direction which is a scanning direction by the radar used for the application detected early The suitable antenna beam for this purpose is a fan beam [narrow in a longitudinal direction] large to a lengthwise direction.
[0003]
[Problem(s) to be Solved by the Invention] However, by the radar used for the above-mentioned purpose, although a longitudinal direction is made to carry out both-way actuation of the fan beam at a high speed, and there is nothing if it is ****, in the method which the alternation of a RRC and the RLC is carried out [method], makes the whole antenna perform mechanically, and makes a fan beam reciprocate right and left, a limitation is in a scan speed and there is a problem that phase control is troublesome, with the method using a phased array.
[0004] This invention was made in view of such a problem, and the purpose is in a high speed in a longitudinal direction with an easy configuration offering the radar antenna which can generate the fan beam which carries out both-way actuation.
[0005]

[Means for Solving the Problem] In order to attain said purpose, the radar antenna of this invention has a configuration like a degree. Namely, the radar antenna of this invention Reflecting mirror with which it is the reflecting mirror of an oblong four-side form, and the direction cross section of a short hand makes parabolic; Waveguide slot array which a reflecting mirror side is made to point to the rf radiation wall surface in which many slots are formed in the focal location of said reflecting mirror, and the location which was in agreement in general, and is arranged; It is a bell shape dielectric. The centrum by which penetration arrangement of said waveguide slot array is carried out is a rotation drive dielectric centering on the medial axis of an outside cylinder although it is cylindrical, while it is not in agreement with the medial axis of an outside cylinder, and the medial axis inclines and is formed.; It is characterized by having.

[0006]

[Function] Next, an operation of the radar antenna of this invention constituted is explained like the above. Since waveguide slot array can make the electromagnetic wave to which the phase was equal from each slot emit, an electromagnetic wave with the wave front of the shape of a cylinder centering on a tube axis is emitted, and when there is no dielectric, the electromagnetic wave reflected and injected with a reflecting mirror turns into a plane wave with a wave front parallel to the tube axis of waveguide slot array. And if a dielectric intervenes, the orientation of a plane wave will be bent according to the refraction operation, but since the centrum is carrying out eccentricity of the dielectric so to speak, the orientation of a plane wave carries out both-way change in a longitudinal direction by the rotation. The rate of this both-way actuation can be set as arbitration by control of the rotational speed of a dielectric, and can attain improvement in the speed easily. Moreover, since the reflecting mirror is oblong, the radiation beam of a reflecting mirror is a fan beam [narrow in a longitudinal direction] large to a lengthwise direction.

[0007] Thus, according to this invention, the fan beam which carries out both-way actuation can be generated in a high speed in a longitudinal direction with an easy configuration.

[0008]

[Example] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 shows the radar antenna concerning one example of this invention. This radar antenna is fundamentally equipped with a reflecting mirror 1, the waveguide slot array 2, a dielectric 3, and a drive motor 31.

[0009] Although the detail of each part is shown in drawing 2 thru/or drawing 4 , a reflecting mirror 1 is the thing of an oblong four-side form, and the direction cross section of a short hand is making parabolic.
[0010] Although arranged in parallel with the mirror plane of a reflecting mirror 1, many slots 21 are drilled by that one wall surface at fixed spacing, and the waveguide slot array 2 forms an rf radiation wall surface, makes a reflecting mirror side point to this rf radiation wall surface in the location of the focus 4 of a reflecting mirror 1, and the location which was in agreement in general, and is arranged.
[0011] This centrum is cylindrical, although the dielectric 3 has structure which is a bell shape thing, and can be rotated focusing on the medial axis 32 of an outside cylinder with a drive motor 31 where penetration arrangement of the waveguide slot array 2 is carried out into that centrum, moreover, that medial axis is not in agreement with the medial axis 32 of an outside cylinder, and inclines and is formed.
[0012] In the above configuration, although drawing 3 and drawing 4 have shown that electric supply to waveguide slot array is performed from the left in drawing, if arrangement spacing of a slot 21 is set as spacing equal to the guide wave length of the electromagnetic wave which spreads the inside of a waveguide, the phase of the electromagnetic wave emitted from each slot 21 will become equal, and an electromagnetic wave with the wave front of the shape of a cylinder centering on a tube axis will be emitted from the waveguide slot array 2.
[0013] Therefore, when a dielectric 3 does not exist, the electromagnetic wave reflected and injected with a reflecting mirror 1 turns into a plane wave with a wave front parallel to the tube axis of the waveguide slot array 2. And sequential change is carried out with (a) ->(b) ->(c) -> (a) in a longitudinal direction, corresponding to a rotation condition, as the orientation of a plane wave is shown in drawing 5, since a centrum, so to speak, carries out eccentricity of the dielectric 3 although the orientation of a plane wave will be bent according to the refraction operation if a dielectric 3 intervenes, and it is moreover rotating, and both-way change is carried out. The rate of this both-way actuation can be set as arbitration by control of the rotational speed of a dielectric 3, and can be accelerated easily.
[0014] And since the reflecting mirror 1 is oblong, the radiation beam of a reflecting mirror is a fan beam [narrow in a longitudinal direction] large to a lengthwise direction.
[0015] Thus, the fan beam by which both-way actuation is carried out can be generated in a high speed in a longitudinal direction with an easy

configuration.
[0016]
[Effect of the Invention] As explained above, in the radar antenna of this invention, penetration arrangement of the waveguide slot array is carried out into the centrum of the dielectric of the shape of a cylinder equipped with the centrum which carried out eccentricity so to speak, a dielectric is rotated, and the fan beam by which both-way actuation is carried out can be generated in a high speed in a longitudinal direction with the easy configuration of carrying out both-way change of the course of the electric wave which reaches an oblong reflecting mirror to a longitudinal direction. Therefore, by the radar using the antenna concerned, lateral resolution can be raised easily, and it is effective in the ability to offer the suitable radar antenna for the radar which carries in a car and is used for the purpose of detection, such as an obstruction, by it.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the appearance block diagram of the radar antenna concerning one example of this invention.
[Drawing 2] It is the sectional view which cut the radar antenna of drawing 1 in respect of being perpendicular to the tube axis of waveguide slot array.
[Drawing 3] It is the sectional view showing the relation between waveguide slot array and a dielectric.
[Drawing 4] It is the schematic diagram of the rf radiation wall surface of waveguide slot array.
[Drawing 5] It is an explanatory view of operation.

[Description of Notations]
1 Reflecting Mirror
2 Waveguide Slot Array
3 Dielectric
4 Focus
21 Slot
31 Drive Motor
32 Medial Axis

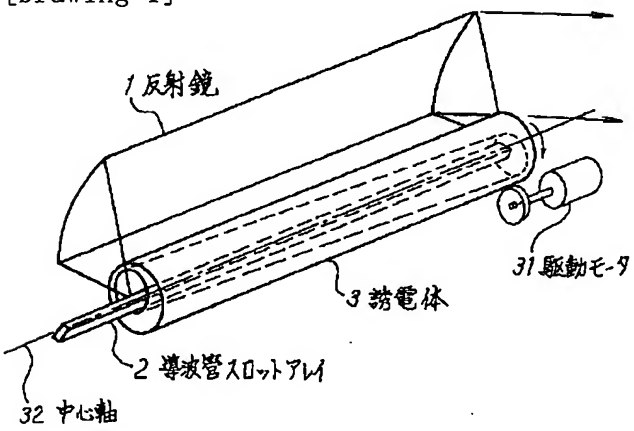
[Translation done.]

* NOTICES *

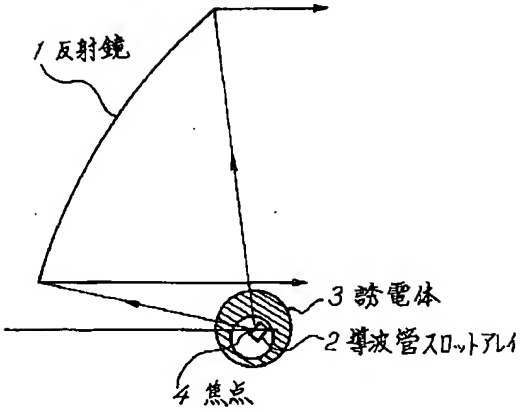
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

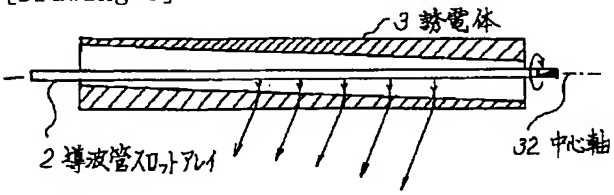
[Drawing 1]



[Drawing 2]

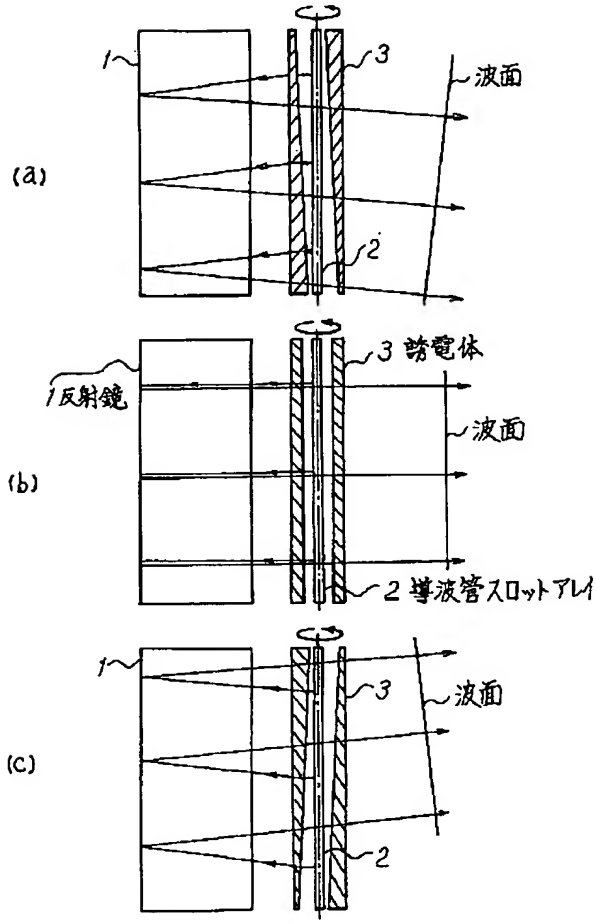


[Drawing 3]



[Drawing 4]

[Drawing 5]



[Translation done.]